

## CLAIMS

1. Apparatus for generating sinusoidal pressure waves for application to a mandrel, said apparatus including

5 a cylinder including a chamber which has a bore, an inlet gallery and an exhaust gallery,

a work piston adapted to have reciprocal movement in the bore of the chamber and having a radial wall which will seal against the wall of the bore of the chamber  
10 during its reciprocal movement within the chamber,

the work piston having a first land at one end of the work piston and a second land at the second end of the work piston,

15 means to alternately

duct fluid under pressure from the inlet gallery into the bore of the cylinder above the first land of the work piston and be exhausted from the bore below the second land of the piston into the exhaust gallery to move the work piston within the bore, and

20 to duct fluid under pressure from the inlet gallery into the bore of the cylinder below the second land of the work piston and be exhausted from the bore above the first land of the piston into the exhaust gallery to reciprocate the piston within the bore,

a piston shaft connected to the work piston and adapted to transmit the forces generated by the reciprocatory motion of the piston to a mandrel.

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2. Apparatus for generating sinusoidal pressure waves for application to a mandrel as claimed in claim 1, wherein each inlet gallery of the piston has an inlet port to enable pressurised fluid to enter the gallery, said inlet gallery communicating with the bore of the cylinder through a port which terminates at the surface of the wall of the bore.

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3. Apparatus for generating sinusoidal pressure waves for application to a mandrel as claimed in claim 1, wherein the chamber includes a relief bore having a first end open to the bore of the cylinder above the first radial face of the work piston and having a second end open to the bore of the cylinder below the second radial face of the work piston, said relief bore including a reciprocable relief piston, the movement of which is determined by the movement of fluid into and out of the relief bore from the cylinder chamber.

4. Apparatus for generating sinusoidal pressure waves for application to a mandrel as claimed in claim 3, including

a relief bore located in the chamber,

a relief piston located in the relief bore and adapted to have reciprocal movement within the bore and to seal against the wall of the relief bore during its reciprocal movement,

a first relief bypass which communicates with the portion of the bore of the cylinder at one end of the work piston and with the relief bore at one end of the relief piston,

a second relief bypass which communicates with the portion of the bore of the cylinder at the second end of the work piston and which communicates with the relief bore at the second end of the relief piston,

the construction and arrangement being that as the work piston moves in one direction within the bore of the cylinder, fluid within the bore at a first end of the cylinder will be forced through the first relief bypass into the first end of the relief bore to move the relief piston within the relief bore to pressurize fluid within the second end of the relief bore and to move fluid through the second relief bypass into the second end of the bore of the cylinder.

5. Apparatus for generating sinusoidal pressure waves for application to a mandrel as claimed in claim 1, wherein each inlet gallery extends 360° around the wall of the chamber.

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6. Apparatus for generating sinusoidal pressure waves for application to a mandrel as claimed in claim 1, wherein the body of the work piston includes a first transfer gallery extending longitudinally through the body and communicating through the radial wall of the work piston with said inlet gallery for a predetermined time during the reciprocary movement of the work piston and also communicating with the bore of the cylinder through the first radial face of the work piston.

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7. Apparatus for generating sinusoidal pressure waves for application to a mandrel as claimed in claim 1, wherein the body of the work piston includes a second transfer gallery extending longitudinally through the body and communicating through the radial wall of the work piston with said inlet gallery for a predetermined time during the reciprocary movement of the work piston and also communicating with the bore of the cylinder through the second radial face of the work piston.

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8. Apparatus for generating sinusoidal pressure waves for application to a mandrel as claimed in claim 1, wherein the chamber includes two exhaust galleries,

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the first exhaust gallery communicating with the cylinder chamber above the first radial face of the work piston and

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the second exhaust gallery communicating with the bore of the cylinder below the second radial face of the work piston,

the first and second exhaust galleries including outlet ports to enable fluid within the galleries to be ducted away from the bore of the cylinder.

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9. Apparatus for generating sinusoidal pressure waves for application to a mandrel as claimed in claim 1, wherein the location of the opening of the first transfer gallery in the radial wall of the work piston is offset longitudinally to the opening of the second transfer gallery in the radial wall of the work piston.

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10. Apparatus for generating sinusoidal pressure waves for application to a mandrel as claimed in claim 1, wherein the cylinder is supported by a rig and the work piston includes a piston shaft which is connectable to the mandrel.

10 11 Apparatus for generating sinusoidal pressure waves for application to a mandrel as claimed in claim 1, wherein the cylinder chamber forms part of a drill head which includes a ballast weight.